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ABSTRACT

An attempt is made in the present paper to resolve inconsistencies between the results of recent studies which have reported that bilingualism is associated with positive cognitive consequences and earlier studies which suggested that bilingualism might adversely affect cognitive and scholastic progress. Because recent studies involved balanced bilinguals and were carried out in "additive" bilingual settings, the bilingual subjects in these studies are likely to have attained a high level of competence in the second language (L2) at no cost to their level of competence in the first language (L1). However, earlier studies tended to involve bilingual subjects from language minority groups whose L1 was gradually being replaced by their L2. Thus, it is not surprising that many of these earlier studies produced evidence of a "balance effect," i.e., that a bilingual paid for his L2 competence by a lowering of his L1 competence. On the basis of the differences in linguistic competence attained by the bilingual subjects in earlier and more recent studies it is hypothesized that the level of linguistic competence attained by a bilingual child may mediate the effects of his bilingual learning experiences on cognitive growth. Specifically, there may be a threshold level of linguistic competence which a bilingual child must attain both in order to avoid cognitive deficits and allow the potentially beneficial aspects of becoming bilingual to influence his cognitive functioning. (Author)

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ABSTRACT

The Influence of Bilingualism on Cognitive Growth: A Synthesis of Research findings and Explanatory Hypotheses

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An attempt is made in the present paper to resolve inconsistencies between the results of recent studies which have reported that bilingualism is associated with positive cognitive consequences and earlier studies which suggested that bilingualism might adversely affect cognitive and scholastic progress. Because recent studies involved balanced bilinguals and were carried out in "additive" bilingual settings, the bilingual subjects in these studies are likely to have attained a high level of competence in L_2 at no cost to their level of competence in L_1. However, earlier studies tended to involve bilingual subjects from language minority groups whose L_1 was gradually being replaced by their L_2. Thus, it is not surprising that many of these earlier studies produced evidence of a "balance effect", i.e. that a bilingual paid for his L_2 competence by a lowering of his L_1 competence. On the basis of the differences in linguistic competence attained by the bilingual subjects in earlier and more recent studies it is hypothesised that the level of linguistic competence attained by a bilingual child may mediate the effects of his bilingual learning experiences on cognitive growth. Specifically, there may be a threshold level of linguistic competence which a bilingual child must attain both in order to avoid cognitive deficits and allow the potentially beneficial aspects of becoming bilingual to influence his cognitive functioning.

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The Influence of Bilingualism on Cognitive Growth: A Synthesis of Research Findings and Explanatory Hypotheses[1]

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In recent years there has been a remarkable reversal of the research evidence regarding the influence of bilingualism on cognition. Investigations of the relationship between bilingualism and cognition conducted prior to the Peal and Lambert study in 1962 generally found that bilinguals performed at a lower level than unilinguals on measures of verbal intelligence (see reviews by Darcy, 1953: Jensen, 1962; Macnamara, 1966: Peal and Lambert, 1962). The results of the Peal and Lambert study and of the majority of subsequent investigations are in marked contrast to the results of earlier studies. These more recent studies indicate that at least in some bilingual learning situations, bilingualism can accelerate the development of non-verbal, and, indeed verbal abilities (Bain, 1974; Cummins and Gulutsan, 1974a; Liedke and Nelson, 1968; Peal and Lambert, 1962). There is also evidence that becoming bilingual facilitates aspects of cognitive flexibility (Balkan, 1970; Ben Zeev, 1972; Ianco-Worrall, 1972). In addition, the research evidence points towards a positive association between divergent thinking skills and learning a second language in early childhood (Carringer, 1974; Cummins and Gulutsan, 1974a; Landry, 1974; Scott, 1973).

The present paper is concerned with the question of how do we resolve the contradiction between studies which have reported that bilingualism is associated with lower levels of cognitive performance and the more recent studies which have tended to suggest that bilingualism might accelerate aspects of cognitive growth? In order to establish a framework for the interpretation of these seemingly inconsistent findings

it is necessary to review the relevant literature and examine those factors which differentiate these two sorts of studies. On the basis of this review, I shall suggest that the level of linguistic competence attained by a bilingual child may mediate the effects of his bilingual learning experiences on cognitive growth. Specifically, there may be a threshold level of linguistic competence which a bilingual child must attain both in order to avoid cognitive deficits and allow the potentially beneficial aspects of becoming bilingual to influence his cognitive functioning. Finally, I shall briefly review some of the factors which might positively influence the cognitive functioning of bilingual children who overcome difficulties in coping with two languages.

The Research Evidence

The introduction of standardized I.Q. tests in the early 1920's presented investigators with what appeared to be a straightforward means of discovering whether bilingualism affected intellectual abilities. However, as Peal and Lambert (1962) point out, many of the early studies which compared the I.Q. scores of unilinguals and bilinguals suffered from methodological defects in that they failed to control for confounding variables such as socio-economic status (SES), sex and the degree of the bilingual's knowledge of his two languages. The only clear trend that emerged from these studies was that bilinguals seemed to suffer from a language handicap when measured by verbal tests of intelligence (Darcy, 1953; Peal and Lambert, 1962). Peal and Lambert conclude their review of the literature as follows:

> "In view of the weakness of the studies reviewed, the best general conclusion is that there is little evidence to suggest that bilinguals differ from monolinguals on non-verbal intelligence, but that there may be differences in verbal intelligence as measured by intelligence tests (1962, p.5)".

Several studies conducted since the Peal and Lambert (1962) study add to the evidence that bilinguals may experience difficulties in expressing their intelligence through language. Macnamara (1966) reported that Irish primary school children, whose home language was English but who

were instructed through the medium of Irish, were eleven months behind in problem arithmetic relative to other Irish children taught through the medium of English. The problem arithmetic test was expressed in sentences and presumably involved the mediation of language. No differences were evident between the groups on a mechanical arithmetic test whose problems were expressed in arithmetical symbols.

A recent study conducted by Tsushima and Hogan (1975) reported that grade four and five Japanese-English bilinguals performed at a significantly lower level than a unilingual control group on measures of verbal and academic skills. The bilingual and unilingual groups in this study were matched on non-verbal ability. The bilingual group was comprised of children whose mothers were born and raised in the United States. All of the parents of children in the unilingual group were born and raised in the United States. Tsushima and Hogan report that the bilingual children had been exposed to both English and Japanese in the home from infancy. However, no details are given of the bilinguals' relative competence in both languages, i.e. their degree of bilingualism.

A study conducted in Singapore (Torrance, Gowan, Wu and Aliotti, 1970) reported that children in grades three, four and five who were attending bilingual schools performed at a significantly lower level on the fluency and flexibility scales of the Torrance Tests of Creative Thinking (Figural Form A). However, the direction of the trend was reversed for originality and elaboration and differences in elaboration in favour of the bilingual group were significant. The trend for the superiority of the bilingual group on the originality and elaboration scales became stronger when corrections for fluency were made. The authors attribute the lower scores of the bilingual group on the fluency and flexibility scales to the influence of interference of associations in bilingualism. The results of this study are consistent with the results of a previous study in Singapore conducted by Gowan and Torrance (1965) who reported that Chinese, Malayan and Tamilese children between grades three and five, who were receiving instruction through their native language, performed at a significantly higher level on a non-verbal measure of ideational fluency than children who were receiving instruction through a second language (English). However, at the grade

six level Chinese pupils receiving instruction in English did as well as Chinese pupils instructed through Chinese. This finding may be related to the fact that the sixth graders are likely to have attained a greater mastery of English than pupils in earlier grades. However, in neither of these studies in Singapore are details given of the degree of bilingualism of the bilingual pupils involved.

In summary, the results of a large number of studies indicate that, under some conditions, bilingualism, or rather the attempt to become bilingual, can adversely affect some cognitive processes. Negative effects have been reported most frequently in the areas of verbal and scholastic achievement and it thus seems reasonable to infer that many of the bilingual subjects in these studies failed to overcome difficulties in coping with two languages. It will be argued later that the positive cognitive consequences reported in many recent studies are a reflection of the fact that the bilingual subjects in these studies are likely to have overcome difficulties in coping with two languages.

The best known of these recent studies is that conducted by Peal and Lambert (1962) with French-English bilinguals in Montreal. Because several earlier studies had produced trivial results by attempting to measure the verbal intelligence of bilinguals through their weaker language, Peal and Lambert controlled for degree of bilingualism by using only bilinguals who had attained a relatively similar degree of competence in both languages, i.e. "balanced" bilinguals. Within the context of previous studies Peal and Lambert's findings were startling to say the least. Not only did the group of balanced ten year old bilinguals show a higher level of non-verbal intelligence than the unilingual control group, they also performed at a higher level on measures of verbal intelligence - a complete reversal of previous findings. The contentious issue of whether or not the use of only balanced bilinguals in the Peal and Lambert study, and in subsequent studies, may have introduced a bias into the comparison of bilinguals and unilinguals (Macnamara, 1966), will be examined in a later section. For the moment, it is sufficient to note that the majority of more recent studies have taken precautions to ensure that the bilingual subjects have had a similar degree of competence in both languages and

therefore, their results tell us nothing about the cognitive abilities of bilinguals who may have remained very much more dominant in one of their two languages.

The Peal and Lambert (1962) study was replicated in a Western Canadian setting by Cummins and Gulutsan (1974a) and similar results were reported. A group of balanced bilinguals was matched with a control group of unilinguals on SES, sex and age and was found to perform at a significantly higher level both on measures of verbal and non-verbal ability and on one measure of divergent thinking, i.e. verbal originality.

Two other studies carried out in Western Canada by Liedke and Nelson (1968) and by Bain (1974) also suggest that bilingualism might accelerate aspects of cognitive growth. In both these studies children who had become bilingual before coming to school showed higher levels of concept formation than control groups of unilinguals. The bilingual and unilingual groups in these two studies were matched on intelligence as well as on SES and sex.[2]

A study conducted in Switzerland by Balkan (1970) produced evidence to support the hypothesis that the attainment of balanced bilingualism might have a positive effect on "cognitive flexibility". Balkan matched balanced bilinguals and unilinguals on non-verbal intelligence and found that the bilingual group performed at a significantly higher level on two variables which he claimed measure "cognitive flexibility". One of these tests was similar to the Embedded Figures Test and involved an ability to restructure a perceptual situation (Figures Cachées). The other test required a sensitivity to the different meanings of words (Histoires). When Balkan separated his bilingual group into bilinguals who had learned both languages before the age of four and those who had become bilingual after the age of four, he found that the superiority of the early bilinguals over their matched unilingual counterparts was much more pronounced than that of the later bilinguals. The later bilinguals were only slightly superior to the control group on the measures of cognitive flexibility. This finding may be related to evidence summarised by Engle (1975, p. 311-312) that children in the early concrete operational period (approx. 6 - 8 years) experience more difficulty in learning a second language than do children at either a younger (before 6)

or older (9 - 12) age level.

Other studies, carried out by Ben-Zeev in 1972 with Hebrew-English bilinguals and by Ianco-Worrall (1972) with Africaans-English bilinguals also support the hypothesis that bilingualism might positively influence aspects of cognitive flexibility. Ben-Zeev reported that her bilingual group had greater skill at auditory reorganization of verbal material, a more "flexible manipulation of the linguistic code" and were more advanced in concrete operational thinking. Ianco-Worrall's (1972) study provides empirical support for Leopold's (1949) hypothesis that the simultaneous acquisition of two languages in early childhood accelerates the separation of sound and meaning or name and object. She found that, of the 4 - 6 year old bilinguals in her sample, 54% consistently chose to interpret similarity between words in terms of a semantic rather than an acoustic dimension, whereas practically none of the unilingual group showed similar choice behavior. The author concludes that

> "... bilinguals, brought up in a one-person, one-language environment, reach a stage in semantic development ... some 2-3 years earlier than their unilingual peers. A high percentage of these bilingual youngsters perceived relationship between words in terms of their symbolic rather than their acoustic properties ... (1972, p.1398)".

Although the majority of studies considered above have involved children who had become bilingual before coming to school, there is also evidence that exposure to an immersion or bilingual education program, in addition to promoting high levels of functional bilingualism, might positively affect some cognitive processes. The pilot class in the St. Lambert project, for example, have performed at a significantly higher level than the controls on measures of divergent thinking at the grades three, five and six levels (Bruck, Lambert and Tucker, 1973). Using data from the pilot and follow-up classes in the Lambert project, Scott (1973) has analysed the relation of divergent thinking to bilingualism. An analysis of covariance with Raven I.Q. scores and SES as covariates, showed significant differences in favour of the bilinguals on divergent thinking tests administered in the later grades of elementary school. In addition, the level of French speaking skills attained by children

in the program was significantly predicted by their earlier (grade three) levels of divergent thinking. Scott argues from these results that bilingualism can both influence and be influenced by divergent thinking. In other words, the results are consistent with the interpretation that divergent thinking skills have been positively affected by the experimental program and also that they have acted as a causal agent in promoting functional bilingualism.

Further indications of a positive association between second language learning and divergent thinking come from studies conducted by Landry (1974) and by Carringer (1974). Landry reports that grade six children attending schools where a FLES program (i.e. between 20 and 45 minutes of second language instruction per day) was operative, scored significantly higher than a unilingual control group on both the verbal and figural parts of the Torrance Tests of Creative Thinking. Differences between FLES and non-FLES schools at the grade one and four levels were non-significant. Landry argues from these results that learning a second language in elementary school might increase divergent thinking skills.

Carringer's (1974) study, conducted in Mexico, found that 24 Spanish-English balanced bilinguals performed at a significantly higher level than 24 Spanish-speaking unilinguals on the verbal flexibility, verbal originality, figural fluency and figural originality scales of the Torrance Tests of Creative Thinking. These results, however, should be treated with caution since neither I.Q. nor SES appears to have been adequately controlled.

The Torrance et al. (1970) and Cummins and Gulutsan (1974a) studies, mentioned previously, suggest that bilingual learning experiences in the school may have a more positive effect on the "originality" than on the "fluency" or "flexibility" aspects of divergent thinking. Torrance et al. reported lower levels of fluency and flexibility among bilingual children in Singapore but, when corrections for fluency were made, higher levels of originality and elaboration. Cummins and Gulutsan found highly significant ($p < .001$) differences between balanced bilingual and unilingual groups on a measure of verbal originality but no differences on fluency or flexibility measures.

In a later analysis, Cummins (1975) compared the cognitive characteristics of balanced (N = 12) and non-balanced (N = 11) grade six children from English-speaking home backgrounds who were attending the French-English bilingual program in Edmonton, Canada. An analysis of covariance with SES as covariate showed no differences between the groups on verbal or non-verbal intelligence but significant differences ($p < .01$), in favour of the balanced group, on the fluency and flexibility scales of a measure of verbal divergence. Differences between the groups on the originality scale approached significance ($p < .08$). Two interpretations of these findings are possible: in the first place, since the balance scores for children from English-speaking homes are an index of French competence, it may be that verbal divergence is a correlate of ability to learn a second language in a bilingual program. This interpretation is consistent with Scott's (1973) finding that divergent thinking abilities significantly predicted later French-speaking skills of the experimental children in the St. Lambert project.

However, Scott's analysis also suggests that divergent thinking may have been influenced by the St. Lambert experimental program and the differences between balanced and non-balanced groups in the Cummins (1975) study can be interpreted in a similar way. If these differences have been caused by the bilingual program it is necessary to ask whether the program has positively influenced the divergent thinking skills of children who have attained balanced bilingual skills or negatively influenced the divergent thinking skills of those who have remained very much more dominant in English. In order to give an indication of whether the differences between balanced and non-balanced groups were due to the relative superiority of the balanced group or the relative inferiority of the non-balanced group, the divergent thinking performance of these two groups was compared with that of a unilingual group. The unilingual group ($N=12$) was matched with both bilingual groups on verbal and non-verbal abilities and with the balanced group on SES. On the verbal fluency and flexibility scales the unilingual group scored at a similar level to the balanced group but substantially higher than the non-balanced group. On the verbal originality measure the unilingual group scored at a similar level to the non-balanced group but substantially lower than the balanced group.

These differences approach but fail to reach statistical significance; nevertheless, they suggest that if divergent thinking skills have been influenced by the bilingual program the verbal fluency and flexibility skills of the non-balanced children may have been negatively affected and the verbal originality skills of the balanced children positively affected.[3] This interpretation parallels the findings of the Torrance et al. study and suggests the possibility that the lower levels of fluency and flexibility observed in the Torrance et al. study may be attributable only to those bilinguals who had failed to overcome difficulties in coping with two languages. By the same token, only those bilinguals who had overcome linguistic difficulties may have been at an advantage in originality and elaboration skills.

The findings of the Cummins (1975) study can be regarded only as suggestive due both to the small number of subjects involved and the fact that different interpretations of the results are possible. The reason these findings have been considered in detail is that they throw light on the cognitive characteristics of children who have attained only intermediate levels of bilingual skills. The findings suggest the hypothesis that the influence of bilingual learning experiences on cognitive functioning may be mediated by the level of competence which a bilingual child attains in the languages through which he must interact with his environment.

In summary, the findings of recent studies suggest that becoming bilingual, either as a result of home or school experiences, can positively influence aspects of cognitive functioning. There are indications in these studies that bilingual learning experiences in the school setting may be more capable of influencing divergent than convergent thinking skills. However, early or pre-school bilingualism does appear capable of accelerating the development of convergent skills.

These recent findings are clearly inconsistent with the findings of earlier studies. In order to resolve this inconsistency it is necessary to develop a conceptual framework within which similarities and differences between early and more recent studies can be specified.

A first step towards the development of such an interpretative framework is to abaondon the expectation that research into the psychological consequences of bilingualism should produce completely consistent results. The search for consistent research results is based on a false premise - i.e. that there is but one single phenomenon or state called "bilingualism" which ought to influence the mental lives of all bilinguals in much the same way. In fact, as Mackey (1971) points out, there is an enormous variety of bilingual learning situations, in each of which, different combinations of cognitive, attitudinal, social and educational factors are operative. Thus, the learning of two languages is likely to affect cognition in different ways depending on the age at which the languages are learned, whether they are learned separately or simultaneously, the opportunities for using both languages in the home, school and wider environment, the prestige of the two languages, the functions which the languages serve within a particular social context etc. In short, each bilingual learning situation is unique and it is impossible to generalize from one bilingual learning situation to another. Consequently, the question for research is not what effects does "bilingualism", per se, have on cognitive processes; rather, research should be directed towards identifying those conditions under which bilingual learning experiences are likely to retard or, alternatively, accelerate aspects of cognitive growth.

In this regard, the more recent studies which have reported positive cognitive consequences associated with bilingualism differ from many earlier studies both in methodology and in the socio-cultural contexts in which the studies were carried out. I shall consider these methodological and socio-cultural differences in turn and argue that, as a result of these differences, the bilingual subjects in recent studies are likely to have differed substantially from those of earlier studies in the level of linguistic competence attained as a result of their bilingual learning experiences.

Methodological Factors

The principal methodological difference between early and more recent studies concerns the procedures for choosing the bilingual sample. The

majority of more recent studies, following Peal and Lambert (1962), have taken precautions to ensure that the bilingual subjects had developed a similar level of competence in both languages, i.e. were balanced bilinguals. Earlier studies, on the other hand, tended to use the bilingual subjects' competence in L_1 and L_2 as dependent variables and consequently, did not select only bilinguals who had developed balanced bilingual skills. The use of only balanced bilinguals in the Peal and Lambert study has been controversial (Macnamara, 1966) and needs to be considered in some detail. First, however, some of the methodological problems inherent in comparing the cognitive performance of bilingual and unilingual groups should be briefly pointed out.

In order to isolate the effects of linguality, bilingual and unilingual groups should be matched on any personal or background characteristic which might contribute to performance on the dependent variables. Peal and Lambert mention SES, sex and age as most important in this respect and point out that many earlier studies were methodologically deficient in that they failed to match bilingual and unilingual groups on these variables. In many studies which have used measures other than non-verbal intelligence as dependent variables (e.g. verbal ability, scholastic achievement, divergent thinking skills) bilingual and unilingual groups have also been matched on non-verbal intelligence. This "cognitive matching" undoubtedly increases the degree to which non-linguistic variables are controlled. Studies which have used non-verbal intelligence as a dependent variable and consequently matched bilingual and unilingual groups only on SES, sex and age (e.g. Cummins and Gulutsan, 1974a; Peal and Lambert, 1962), are subject to the criticism that an index of SES, based on parental occupation, may not adequately control all relevant background differences between the groups. The studies of Davé (1963) and Wolf (1966) have shown that such an index of SES is likely to account for only a relatively small proportion of differences in children's home environments. The inevitable margin for error in matching bilingual and unilingual groups argues for caution in accepting the results of any one study without confirmatory evidence from other studies which have used different approaches and which have been carried out in different bilingual learning situations.

The most controversial aspect of the Peal and Lambert study was their method of choosing the bilingual sample. Four measures were used to estimate the degree of French-English linguistic balance. These measures consisted of (1) a word association test in which the ratio of French-English word associations to stimulus words in each language was used to form a balance score; (2) a word detection test in which subjects had to find French and English words embedded in a series of letters; (3) the Peabody Picture Vocabulary Test which was used as a measure of oral English competence; (4) a subjective self-rating measure in which subjects rated their ability to speak, read, write and understand English. In cases where the different criteria were in disagreement Peal and Lambert gave more weight to the child's vocabulary score than to the other measures.

Macnamara (1966) has criticized Peal and Lambert's study on the grounds that their use of these measures in choosing the bilingual sample invalidates any linguistic comparison between bilingual and unilingual groups. He argues that

> "... it is extremely likely that in selecting for the bilingual group native French-speakers who had become balanced bilinguals, the authors selected children who on the whole were highly gifted and had a flair for language learning. So any linguistic comparison between these children and the monoglots was probably biased in favour of the former (1966, p.21)".

Lambert and Anisfeld (1969), in a reply to Macnamara, have argued that the measures of linguistic balance did not bias the comparison in favour of the bilinguals. They make the point that these measures allowed children who had a low level of competence in both French and English to enter the bilingual sample and thus did not select only children with a flair for language learning.

Two inter-related issues in this controversy need to be distinguished. The first is whether or not any bias existed in the balance measures themselves. In other words, did these tests favour bilingual children who were more intelligent or verbally proficient? Secondly, is it, in principle, invalid to compare unilingual children with a

selected group of balanced bilinguals, or, ought the bilingual sample be representative of all bilinguals - balanced and non-balanced?

Measures of linguistic balance are designed to measure a bilingual's relative degree of competence in L_1 and L_2. Performance on these measures may be correlated with intelligence or verbal proficiency, either because more intelligent children tend to become more balanced or, alternatively, because the attainment of balanced bilingualism may influence intellectual development. However, the tests themselves ought not to be loaded towards producing this result. In the word association test, for example, a "balanced" bilingual may produce either a large number of words in each language or a small number. If only those individuals who produced a large number of words in each language were accepted as "balanced bilinguals" then this measure would undoubtedly bias the comparison of bilingual and unilingual groups. However, the criterion of balance is the ratio of L_1 : L_2 associations and the absolute number is irrelevant. Thus, there is no inherent tendency in this measure, or in other measures involving the ratio of L_1 : L_2 performance, to select only those bilinguals who may have high levels of intelligence or verbal proficiency.

The problem in the Peal and Lambert study, however, is that, when the different balance measures were in disagreement, more weight was given to the Vocabulary score than to the others. The Vocabulary test was given only in English (L_2) and thus a racio of English:French vocabulary skills was not obtained for this measure. As Peal and Lambert themselves point out this may have led to the omission from the bilingual sample of some bilinguals who may have been balanced but whose vocabulary in both English and French may have been small. Thus, in the Peal and Lambert study the use of the English Vocabulary measure may have led to some degree of bias in the selection of the bilingual sample. The extent of the bias, if it existed, cannot be ascertained in the absence of data on the cognitive abilities of those bilingual children who were not included in the bilingual sample. The fact that subsequent studies have tended to corroborate the Peal and Lambert findings, combined with Lambert and Anisfeld's conviction that no bias existed, may indicate that the extent of the bias, it it did exist, was slight.

In studies subsequent to the Peal and Lambert study there is little

evidence that the procedure used to select the bilingual samples in any way biased the comparison of bilinguals and unilinguals. Studies which used measures of balance invariably used the ratio of $L_1 : L_2$ performance. In some studies (e.g. Balkan, 1970) all of the bilingual children who were tested easily met the criterion of balance and thus none were excluded from the bilingual sample. In several studies (Bain, 1974; Balkan, 1970; Ianco-Worrall, 1972; Liedke and Nelson, 1968; Scott, 1974) the matching of bilingual and unilingual groups on non-verbal IQ, as well as SES, sex and age, provided an additional safeguard against bias.

A recent study (Cummins, 1975) has examined the extent to which the use of measures of linguistic balance may have introduced a bias into the comparison of bilinguals and unilinguals. This study examined the relationship between cognitive performance and the attainment of balance for children from French-speaking homes, English-speaking homes and mixed French-English homes who were attending the bilingual program of the Separate School System in Edmonton, Canada. Within the French and Mixed groups, children who were more balanced in French and English skills tended to perform at a higher level on both intelligence and divergent thinking tasks. However, only a small proportion of children in these groups failed to meet the criterion of balance. Only four children (out of 29) from the French group and six (out of 30) from the Mixed group were classified as non-balanced. The cognitive performance of these non-balanced children tended to be only slightly worse than the performance of children classified as balanced in their respective groups. Thus, their exclusion from the balanced sample in the Cummins and Gulutsan (1974a) study is unlikely to have seriously affected the comparison of bilingual and unilingual groups.

The cognitive characteristics of those children from English-speaking homes who were classified as non-balanced (N=11 out of 23) have been summarised earlier. No differences were found between balanced and non-balanced children on verbal and non-verbal abilities but there were large differences between the groups on measures of verbal divergence. Our main interest here is whether this finding may have been an artifact of the similarity between the word association balance measure and the test

of verbal divergence in which subjects were required to list as many uses as they could think of for two common objects (Utility Test). This possibility was rejected in view of the fact that the correlation between Utility fluency and the ratio of French:English word associations was non-significant (r=-.27) and lower than the correlations between Utility fluency and the other two balance measures (subjective self-rating balance ratio, r=-.45; teacher's rating of relative skills in French and English, r= -.35).

The findings of the Cummins (1975) study have relevance for the second issue in the controversy regarding the use of balanced bilinguals, i.e. whether or not it is legitimate, in principle, to compare unilinguals with a sample of balanced bilinguals to the exclusion of bilingual children who may have remained very dominant in one of their two languages. It could be argued, for example, that a relatively high level of intelligence or, possibly, language learning aptitude, is necessary to become a balanced bilingual and, therefore, comparison of balanced bilinguals and unilinguals on these traits, or traits related to them, is biased in favour of the former. This argument, however, is inconsistent with the lack of any differences in verbal and non-verbal intelligence between balanced and non-balanced children from the English home background group in the Cummins (1975) study. One could, of course, argue from the Cummins data and also from Scott's (1973) findings that divergent thinking skills are related to the ability to become functionally bilingual. This possibility is extremely interesting and the exact relationships between second language learning and divergent thinking skills will undoubtedly be more closely specified in future studies.

Another point is that the criterion of balance in recent studies which have used tests of linguistic balance (e.g. Balkan, 1970; Cummins and Gulutsan, 1974a; Peal and Lambert, 1962) has been quite lenient. As operationally defined in these studies "balance" does not imply complete equilinguality; the procedure is designed only to eliminate those who are very much more dominant in one of their two languages. In the word association balance measure, for example, a ratio of only 5:3 English:French or French:English words was necessary to meet the criterion of balance used in the Balkan (1970) and Cummins and Gulutsan (1974a) studies. In the Peal and Lambert study the criterion was even

more lenient. Thus, a bilingual child who produced 30 English words and only 18 French words to the stimulus words would qualify as "balanced" despite the fact that he is clearly more proficient in English. The point is that a high level of language learning aptitude or intelligence is unlikely to have been necessary to attain the criterion of balance in these studies since this criterion has been so lenient. The finding of no differences in verbal or non-verbal intelligence between balanced and non-balanced groups in the Cummins (1975) study supports this conclusion.

In summary, although the use of a Vocabulary test in selecting the balanced bilingual sample in the Peal and Lambert study may have introduced some degree of bias into the comparison of bilinguals and unilinguals, there is no evidence that the procedures used to select the bilingual samples in subsequent studies in any way biased the comparison of bilingual and unilingual samples.

The fact that recent studies which have reported positive cognitive consequences associated with bilingualism have involved balanced bilinguals, whereas the majority of earlier studies failed to control for degree of bilingualism, by itself provides only a partial picture of the linguistic competence of the bilingual subjects in these two types of studies. It tells us only that bilinguals who were very much more dominant in one of their two languages were not included in recent studies. It does not, however, tell us whether the L_2 competence attained by the bilingual subjects in recent studies was attained at the expense of their competence in L_1 (Macnamara's (1966) "balance effect") or whether these bilingual subjects had a high level of competence in both their languages. In order to specify more precisely the differences in linguistic competence of the bilingual subjects in early and more recent studies, it is necessary to consider the social contexts in which these two types of studies have been carried out.

Bilingualism and Socio-cultural Factors

Paulston (1975) has noted that the socio-economic status of the students is the one overruling factor in distinguishing successful and unsuccessful bilingual education programs. She states that

> "In every single study where monolingual children did as well as or better in L_2 instruction than did native speakers, those children came from upper or middle class homes (1975, p.9.)".

Similarly, in the empirical studies reviewed above, those which reported that balanced bilingualism was associated with higher levels of cognitive performance tend to have compared the performance of bilinguals and unilinguals of relatively high SES. Many of the earlier studies, on the other hand, involved bilinguals who were of low SES. The reason for this was simply that in many countries bilingual communities tended to come from disadvantaged backgrounds (e.g. immigrant groups in the U.S.A., rural children in Wales etc.). A recently published report on bilingual-bicultural education in the U.S.A. has expressed this point:

> "Those individuals who are commonly designated 'bilingual' (they are often not bilinguals but monolingual speakers of a language other than English) in this country are also those who, bearing the brunt of many forms of discrimination, tend to be of a low socioeconomic status such as Mexican Americans, Native Americans, Puerto Ricans, and many immigrant groups. (United States Commission on Civil Rights, 1975, p.68)."

Although it is not difficult to appreciate that the addition of a second language might well exacerbate the problems which lower SES children are reported to experience in coping with just one language (Bernstein, 1971; Edwards, 1975), the label "SES" by itself, provides a very inadequate description of the societal conditions under which bilingual learning experiences can be expected to have either positive or negative cognitive consequences. One need only point to the successful replication of the St. Lambert experiment with working-class children in Montreal (Tucker, Lambert, d'Anglejan, 1973) to demonstrate that more than just SES is involved.

In a more general sociological context the distinction between the bilingualism of upper class children and of lower class children has been expressed in terms of "elitist" and "folk" bilingualism (Paulston, 1975). Elitist bilingualism is a matter of choice and has characterised the educated and upper classes of many societies through-

out the centuries. This type of bilingualism has never been an educational problem. As Fishman (1967) puts it,

> "... where there has been a history of stable intra group bilingualism with real support from the educational system, there has been no history of retardation as a result, but rather a history of assets. Elitist bilingualism throughout world history has been of this kind (1967, p.82)".

Folk bilingualism, on the other hand, is not a matter of choice but is the result of ethnic groups in contact and competition within a single state. This is the situation of many immigrant groups in North America who must become bilingual in order to survive. It is folk bilingualism which has, for the most part, been associated with negative cognitive and academic consequences, and there are many sociolinguistic factors which can be invoked to account, at least partially, for such findings. The attitudes of pupils and parents, the prestige of the bilingual's two languages, the functions which the languages serve within a particular social context, possible negative stereotyping and discrimination against minority language groups and many other factors are all likely to play an important role in explaining the negative effects associated with folk bilingualism.

However, from the point of view of the present paper, one problem with these socio-cultural factors in resolving contradictory research findings is that they are too distant from the actual process of cognitive development. Positive attitudes in the learner, for example, will undoubtedly contribute to the success with which he learns a second language, but they do not explain why learning a second language might positively influence aspects of cognitive functioning. Similarily, negative attitudes may help explain why an individual experiences difficulties in coping with two languages, but the negative attitudes are not the direct determinant of any cognitive difficulties that the individual might experience. In other words, there are intervening variables in the causal chain whose influence needs to be specified. Since these intervening variables seem likely to be related to the linguistic competence attained by bilingual children our main concern in considering socio-cultural factors is whether or not they can

elucidate any differences in the level of linguistic competence attained by bilingual subjects in earlier as compared to more recent studies.

A distinction made by Lambert (1975) between "additive" and "subtractive" bilingualism is helpful in bridging the gap between socio-cultural factors and the actual process of cognitive development. In developing this distinction Lambert attaches special importance to one socio-cultural factor - i.e. the prestige or social relevance of the bilingual's two languages. He notes that in communities where studies have reported positive effects associated with bilingualism, the L_2 has been a socially relevant language, the learning of which is unlikely to lead to replacement of the L_1 (usually a prestigious or dominant language). However, for many ethnic minority groups the learning of L_2 (usually the majority and more prestigious language) is very likely to lead to a gradual replacement of the L_1. Lambert terms the former type of bilingualism "additive" in that the learner is adding a new language to his repertory of skills. The latter type of bilingualism is termed "subtractive" in that the bilingual's competence in his two languages at any point in time is likely to reflect some stage in the subtraction of the L_1 and its replacement by the L_2.

While the distinction between additive and subtractive bilingualism parallels the high SES,low SES and elitist-folk distinctions, it also carries implications for the bilingual's relative degree of competence in his two languages. Subtractive bilingualism, where L_1 is being replaced by L_2, implies that as a bilingual in a language minority group develops skills in L_2, his competence in L_1 will decrease. It seems likely that, under these circumstances, many bilingual children in subtractive bilingual learning situations may not develop native-like competence in either of their two languages. Thus, the concept of "subtractive" bilingualism has affinities both to Macnamara's (1966) "balance effect" hypothesis and to what Scandinavian researchers have described as semilingualism (Hansegard, 1968; Skuttnabb-Kangas, 1975). The "balance effect" hypothesis states that as a bilingual develops skills in one of his two languages, he pays for it by a decrease in competence in the other (Macnamara, 1966). While it has been demonstrated that this hypothesis does not hold in elitist or additive

bilingual learning situations (e.g. the St. Lambert project), it does have relevance for the bilingualism of many language minority groups. Cummins and Gulutsan (1974b), for example, found evidence of a "balance effect" in the linguistic competence of children from French-speaking home backgrounds attending a bilingual program in Edmonton, Canada. The French home language of these children was gradually being replaced by the majority language - English - and by grade six virtually all the children from French-speaking home backgrounds were somewhat dominant in English. The French children rated their competence in both English and French lower than other children in the program (from English and mixed French-English speaking homes) rated their competence in English. The French group also scored significantly lower than the other two groups on a measure of verbal ability (administered in English).

The concept of "subtractive" bilingualism also implies a level of bilingual competence similar in some respects to what Scandinavian researchers have described as "semilingualism". The term "semilingualism" refers to the linguistic competence, or lack of it, of individuals who have had contact with two languages since childhood without adequate training or stimulation in either. As a consequence, these individuals know two languages poorly and do not attain the same levels as native speakers in either language. Scandinavian researchers (e.g. Hansegard, 1968; Skutnabb-Kangas, 1975) have argued that this condition has negative emotional, cognitive, linguistic and scholastic consequences (see Paulston (1975) for a summary of Scandinavian research on "semilingualism").

Since many of the early studies which reported negative cognitive consequences associated with bilingualism involved bilingual children from language minority groups, it seems likely that the L_1 of many of the bilingual subjects in these studies was being replaced by L_2. Consequently, many of these subjects may not have had native-like skills in either of their two languages. These bilingual subjects may very well have been balanced bilinguals i.e. have had relatively equal competence in both languages. However, their L_2 competence is likely to have been achieved at the expense of their L_1 competence.

Recent studies which have reported that bilingualism might positively influence cognitive functioning have, as Lambert (1973) points

out, been conduced in additive bilingual learning situations. There is evidence that in additive situations the L_2 competence achieved by an individual is achieved at no cost to his competence in L_1 (e.g. Cohen, 1975; Cummins and Gulutsan, 1974b; Lambert and Tucker, 1972 etc.). Therefore, the linguistic competence of the "balanced" bilingual subjects in recent studies is likely to have differed considerably from the linguistic competence of "balanced" bilingual subjects in earlier studies. In recent studies, the bilingual subjects are likely to have achieved a high level of L_2 competence at no cost to their L_1, whereas in earlier studies the bilingual subjects are likely to have paid for their L_2 competence by a lowering of their L_1 competence.

It must be remembered, however, that the bilingual subjects in recent studies may not be representative of all children who have undergone bilingual learning experiences in additive settings. In several of these studies bilinguals who have been very much more dominant in one of their two languages have been excluded from the bilingual sample. This raises the question of how the bilingual learning experiences of children who remain very dominant in their L_1, yet are forced, at school or elsewhere, to function through their L_2, will influence their cognitive growth. This question will be considered in the next section which examines the relationship between a bilingual's linguistic competence and his cognitive functioning.

Linguistic Competence and Cognitive Growth

The fact that the bilingual subjects in earlier and more recent studies are likely to have attained very different levels of linguistic competence suggests that the effects of bilingualism on cognitive growth may be mediated by the level of competence an individual attains in his two languages. In the initial stages of becoming bilingual (whether it is in the early years of life or as a result of school experiences), the child's cognitive system will inevitably experience some difficulty in coping with two forms of linguistic input. In some bilingual learning situations the initial difficulty is quickly overcome and the bilingual child rapidly learns both to understand and communicate in the second language at no cost to his native language. The research evidence reviewed earlier indicates that in cases such as this, where access to

both languages is attained and maintained, bilingualism might positively influence the development of cognition. However, in bilingual learning situations where the child fails to overcome difficulties in coping with two languages the research evidence suggests that his bilingual learning experiences might have a negative effect on his cognitive functioning, at least in so far as this functioning involves language. Continued difficulties with language over a prolonged period of time are likely to mean that a bilingual child's interaction with an increasingly symbolic environment will not optimally promote his cognitive and academic progress.

If the level of competence which a bilingual child attains in L_1 and L_2 mediates the effects of his bilingual learning experiences on cognitive growth, then in immersion or bilingual education programs there may be a threshold level of L_2 competence which pupils must attain both in order to avoid cognitive disadvantages and allow the potentially beneficial aspects of becoming bilingual to influence their cognitive functioning. Those aspects of bilingualism which might accelerate cognitive growth seem unlikely to come into effect until the child has attained a certain minimum or threshold level of competence in his second language. Similarily, if a child in an immersion program attains only a very low level of competence in his second language, his interaction with the environment through the medium of that language, both in terms of input and output, is likely to be impoverished. Not only will he fail to comprehend much of the content of schooling but he is also likely to experience difficulty in expressing his developing intelligence and operating (in a Piagetian sense) on the environment through his L_2. One probable consequence of this is a decrease in intellectual and academic curiosity.

It should be made clear at the outset that the threshold level of bilingual competence is an intervening rather than a basic causal variable in accounting for the cognitive growth of bilinguals. Although the cognitive effects of an individual's bilingual learning experiences may be mediated by whether or not he attains the hypothesized threshold level of bilingual competence, the attainment of the threshold is itself determined by more fundamental social, attitudinal, educational and cognitive (e.g. language learning aptitude) factors.

What are the characteristics of this threshold level of bilingual competence? In the first place the threshold cannot be defined in absolute terms; rather, it is likely to vary both with the amount of time that is spent through L_2 and with the type of cognitive operations that must be expressed through L_2. The threshold for a child in a full immersion program is likely to be higher (in absolute terms) than for a child in a bilingual program in which 50% of the time is spent in L_1. Because a greater proportion of his cognitive operations in the school setting must be expressed through the medium of his second language, the immersion child is more likely than the child in the bilingual program to suffer cognitively (and academically) if he fails to develop adequate skills in that language. However, by the same token, the immersion experience seems more likely to promote full functional bilingualism than bilingual programs in which a sizeable proportion of the time is spent through L_1. Thus, the child in am immersion program may more rapidly gain the threshold level of L_2 competence required to reap the cognitive benefits of his bilingual learning experience. This raises the possibility that there may be not one but two thresholds. The attainment of the first threshold would be sufficient to avoid cognitive retardation but the attainment of a second, higher, level of bilingual competence might be necessary to lead to accelerated cognitive growth. This possibility is likely to be investigated in future research on the relationship between bilingualism and cognition. However, for the purposes of exposition in the present paper only one threshold need be posited. In summary, the more time that is spent through the L_2, the higher must be the level of second language competence necessary to avoid cognitive deficits.

The threshold is also likely to vary according to the type of cognitive operations appropriate for a child's stage of cognitive development. A grade six child in an immersion program whose L_2 competence is below the threshold necessary for the adequate expression of his intelligence may have a much higher level of L_2 competence, in absolute terms, than a grade one child whose L_2 competence is above the threshold necessary for the adequate expression of <u>his</u> intelligence. This is so because between grade one and grade six, or roughly between concrete and formal operations, language is likely to increase in importance as an instrument with which the child can operate on his

environment and express his developing intelligence. Possibly one of the reasons why so little cognitive retardation has been observed in the early grades of immersion schooling is that during these grades the child's interaction with the world and, consequently, his cognitive development, is less dependent on the mediation of language than at later grades. This may give the child a "breather" in which he can overcome the inevitable initial difficulties with language and gain the second language skills necessary to optimally benefit from interaction with an increasingly symbolic environment. Even Piagetian theory, which takes a conservative viewpoint on the relationship between language and thought, admits that as the child approaches the formal operational stage, linguistic symbolism becomes more useful as a means of representing cognitive operations. Thus, linguistic difficulties such as inadequate command of the L_2 or interference between L_1 and L_2 are likely to have a greater effect on the child's expression of his intelligence at the formal operational than at the concrete operational stage. This point will be considered in more detail in a later section.

Much of the evidence (see Macnamara, 1967) linking instruction through a weaker language with cognitive and academic difficulties can be reinterpreted in terms of the threshold hypothesis. These difficulties are due not so much to instruction through a weaker language in itself, as to the failure of pupils to attain the threshold level of L_2 competence necessary to benefit from such instruction. Many immersion programs have reported no negative consequences as a result of instruction through a weaker language, the reason being, we would hypothesize, that a relatively high (i.e. threshold) level of L_2 skills was attained by pupils in these programs.

What type of linguistic difficulties characterize individuals who fail to attain a threshold level of linguistic competence? This question cannot be answered in any general way due to the fact that the threshold is likely to vary according to the type of bilingual learning situation and the individual's stage of cognitive development. However, Macnamara's (1967) description of the linguistic difficulties experienced by some bilingual children may serve as a guideline for research on the relationship between linguistic competence and cognitive functioning. Macnamara investigated why grade six bilingual children took longer to

solve problems in their weaker language and concluded that the reasons lay in an inadequate grasp of the language rather than in ignorance of certain words or syntactic structures. He points out that a bilingual's difficulties with language "... can arise from something other than ignorance of certain words, idioms and syntactic structures; they can arise from a fairly generalized unfamiliarity with and poor control of the standard language, at least in written form, so as to affect a student's problem-solving ability adversely (1970, p.34)". In earlier grades, failure to attain the threshold may very well be due to lack of vocabulary or poor command of syntactic structures. However, Macnamara's analysis suggests that in later grades difficulties with language may take quite subtle forms. Elsewhere (1966, p.34-48) Macnamara has discussed the roles of interlingual interference, cultural conflict, faulty linguistic models and lack of time in a language as factors which might contribute to a bilingual's difficulties with language.

Few, if any, of the bilingual pupils in the Montreal and Ottawa immersion programs (Lambert and Tucker, 1972; Barik and Swain, 1975) seem to have experienced prolonged difficulties with language. These programs have demonstrated that, under favourable conditions (e.g. the learning of a socially relevant language, a bilingual environment, highly motivated parents, teachers and pupils), the majority of pupils experience little difficulty in attaining relatively high levels of functional bilingualism. Even children with learning difficulties have fared well in the St. Lambert project (Bruck, Rabinovitch and Oates, 1974). Thus, in additive bilingual learning situations the proportion of children who fail to attain a threshold level of bilingual competence may be very small. However, in bilingual education programs conducted under less favourable conditions a larger proportion of children may remain very dominant in their L_1 and consequently may not optimally benefit from school experiences conducted through L_2.

One implication of the threshold hypothesis for evaluations of bilingual education programs is that pupils who have attained the threshold may perform very differently on cognitive and academic tasks from pupils who have failed to attain the threshold. These different levels of cognitive and academic performance may mask each other when the performance of only the total bilingual group is considered. The research

reviewed earlier indicated that bilingualism could have both positive and negative cognitive consequences and in the present paper it has been hypothesized that these different consequences may be related to the level of linguistic competence attained by a bilingual. If this hypothesis is valid, then evaluations of bilingual education programs should consider the cognitive and academic consequences not only for the group as a whole, but also separately for those who have attained and those who may have failed to attain high levels of L_2 skills.

In summary, as a synthesis of seemingly inconsistent research findings, it has been proposed that there may be a threshold level of bilingual competence which an individual must attain before his access to two languages can begin to positvely influence his cognitive functioning. While an individual's competence in L_2 and/or L_1 remains below this threshold his interaction with the environment through these languages is unlikely to optimally promote his cognitive and academic progress. The threshold hypothesis is doubtless oversimplified and elucidation of the specific characteristics of the threshold in different bilingual learning situations must await future research. Hopefully, however, this hypothesis will have heuristic value since very little research seems to have been carried out in relating a bilingual's level of competence in L_1 and L_2 to his cognitive and academic progress.

One further problem needs to be considered. In discussing the threshold hypothesis it is clear that certain assumptions have been made regarding the relationships between language and cognitive growth. The final section will state and attempt to justify these assumptions. The problems of how failure to overcome difficulties with language might retard cognitive growth and how the attainment of a threshold level of bilingual competence might positively affect cognitive functioning will be briefly considered in relation to the wider issue of the role of language in cognitive development.

Explaining the Research Findings

The threshold hypothesis makes two theoretical assumptions regarding the relation of bilingualism and cognition. The first assumption is that failure to resolve difficulties in coping with two languages over a prolonged period of time can negatively influence an individual's rate of cognitive development. Secondly, the threshold hypothesis assumes that when a certain level of competence in two languages has been attained, there are aspects either of a bilingual's present access to two languages or of his bilingual learning experiences which can positively influence his cognitive functioning. These assumptions are both supported by the research evidence above but their relationship to the wider theoretical issue of the role of language in cognitive development needs to be made explicit.

Two major contrasting positions on the developmental inter-relationships of language and thought can be distinguished. The first, which derives from Piaget's (1970) theory of cognitive development, holds that the development of cognitive operations is essentially independent of language. Although language can prepare an operation and extend its range it is neither a sufficient nor necessary condition for the development of operational thought (Furth and Youniss, 1971; Sinclair-de-Zwart, 1969; Piaget, 1970). Vygotsky's (1962) theory, on the other hand, holds that the development of logical thought is dependent on the internalization of speech. Not only logical thought but the totality of an individual's personality is closely integrated with linguistic experience.

Clearly Vygotsky's position creates no problems for the theoretical assumptions of the threshold hypothesis. However, at first sight the Piagetian position appears less compatible with the assumption that a bilingual's linguistic experience can influence his cognitive growth. Macnamara (1970) has drawn out the apparent implications of a Piagetian position for the relationship between bilingualism and cognitive growth. He argues that because the development of cognition owes little to the influence of language and linguistic functioning is to a great extent dependent on many sorts of non-linguistic cognitive functioning "... it seems unlikely that bilingualism should have any effect

upon the development of the basic, common, cognitive structures (1970, p.33)".

I shall argue, in contrast to Macnamara, that there is no incompatibility between a Piagetian position on the relationship between language and thought and the hypothesis that bilingualism can influence (both positively and negatively under different conditions) the development of cognition.

An appropriate starting point for consideration of the first assumption (i.e. that linguistic difficulties can negatively influence the development of cognition) is Furth's work on the cognitive development of deaf children. The results of an extensive series of studies (Furth, 1966) indicate that deaf children pass through the same operational stages as hearing children even though their performance is somewhat inferior on some tasks. Furth attributes the slight intellectual lag not to the direct influence of language as such but to experiential factors such as the lack of normal social interaction in the deaf which could easily lead to a lower level of intellectual curiosity. Furth and Youniss (1971) sum up their findings as follows:

> "In other words, whereas language is never a sufficient or necessary condition of operatory functioning, the evidence from our work with linguistically deficient persons indicates that it may have, at best, an indirect facilitating effect for concrete operations, but can have a direct facilitating effect on certain formal operations precisely because of the close relation between formal operations and symbolic functioning (1971, p.64."

Language, according to Furth and Youniss, is less closely related to concrete than to formal operations because " ... for the functioning of concrete operatory structures physical events not verbal propositions are primary objects of thinking (1971, p.63)".

From this it can be implied that failure to overcome difficulties with language will have a greater effect on the development of formal operational than on concrete operational thought. By themselves, these difficulties will not prevent an individual from developing formal

operational structures but they may retard the process. In addition to the direct relationship between language and some types of formal operational thinking, the scholastic experiences of individuals who have an inadequate grasp of the language of instruction may be less intellectually satisfying and consequently may not promote intellectual curiosity. A lower level of intellectual curiosity could retard the rate of intellectual development even in areas which do not involve the mediation of language. Thus, even though the major negative effects of failure to overcome difficulties in coping with two languages have been identified in areas which require the expression of intelligence through language, more generalized negative effects should not be discounted. In short, because linguistic experience can facilitate the development of cognition, difficulties in coping with two languages are likely to adversely affect a bilingual child's expression of his intelligence through language, and consequently, his interaction with an increasingly symbolic environment.

In order to examine whether or not the second assumption of the threshold hypothesis (i.e. that bilingualism can positively influence cognitive functioning) is compatible with Piagetian theory, it is necessary to summarize the explanations which have been offered by various investigators to account for findings of a positive association between bilingualism and cognition. These explanations can be reduced to three basic hypotheses which I shall term the "experiential enrichment" hypothesis, the "switching" hypothesis and the "objectification" hypothesis. These hypotheses are, for the most part, still in the speculative stage, the objectification hypothesis being the only one supported by empirical evidence.

The experiential enrichment hypothesis holds that the bilingual child may have been exposed to a wider range of experiences due either to attempts by his parents to compensate for the reduced time he will inevitably spend in each language (Liedke and Nelson, 1968), or because his experiences stem from two cultues (Peal and Lambert, 1962). Although this hypothesis seems plausible in general terms there is no empirical evidence for or against it. It has not been demonstrated that bilinguals are exposed to a wider range of social or cultural stimulation than unilinguals or that, even if they were, this would accelerate their rate of cognitive growth.

The switching hypothesis has been proposed by various investigators (Balkan, 1970; Carringer, 1974; Landry, 1974; Peal and Lambert, 1962) to account for their findings that bilingual children exhibited higher levels of cognitive flexibility or divergent thinking. This hypothesis proposes that bilingual children develop a more flexible learning set as a result of switching languages and making use of two different perspectives. The switching hypothesis as expressed by the investigators mentioned above seems to involve two different explanatory factors depending upon whether one emphasizes the different perspectives provided by two languages or, alternatively the actual process of switching from one language to another. The first interpretation is very similar to the objectification hypothesis and will be considered below. The validity of the second interpretation has been called into question by Cummins and Gulutsan (1975) who found that balanced bilingual and unilingual groups, matched for sex, SES and age, did not differ in ability to extinguish a set as measured by the Uznadze haptic illusion. If bilinguals were, in fact, more adaptable or "willing to change" (Landry, 1974) as a result of alternating languages, this should have been evident on the haptic set test which requires subjects to change an established set or pattern of response.

In conclusion, it should not be uncritically assumed that the actual process of switching between languages has any consequences for the cognitive functioning of bilinguals. However, it is possible that relevant aspects of problem situations may be brought to the bilingual child's attention by the availability of two different linguistic perspectives. This is the basic tenet of the objectification hypothesis to which we now turn. Since the objectification hypothesis attributes the bilingual's cognitive advantage directly to his access to two linguistic codes, the relationship between this hypothesis and the theories of Piaget and Vygotsky will be considered in some detail.

Cummins and Gulutsan (1975) have suggested that several of the hypotheses put forward to explain bilinguals' higher levels of cognitive performance can parsimoniously be subsumed under what Georgian (U.S.S.R.) psychologists have termed the "process of objectification". The term "objectification" refers to the process whereby objects become the focus of conscious attention and, according to Uznadze (1966), this process

arises in the context of social life and is closely linked to language. The objectification process appears to express the essential component of those explanations which emphasize the interplay between object and word or semantics and phonetics. Lambert and Tucker (1972), for example, note the "two-way bilingual relay of concepts and linguistic principles (p.210)" that they have observed among the experimental children in the St. Lambert project from the grade one level on. According to Lambert and Tucker (1972) children in the project "get caught up in a process of comparing and contrasting two linguistic codes" and "this children's version of contrastive linguistics helps them immeasurably to build vocabulary and to comprehend complex linguistic functions (p.208)".

In a similar vein, it has been proposed (e.g. Imedadze, 1960; Leopold, 1949) that the simultaneous acquisition of two languages in early childhood might lead to a faster separation of sound and meaning, thereby directing the bilingual child's attention both to the essential or conceptual attributes of objects (Leopold, 1949) and to the characteristics of his two languages (Imedadze, 1960). Leopold (1949) has argued that

> "A bilingual, who constantly hears two words for one thing, is compelled to pay more attention to the meaning expressed than to the word used to express it, whereas the monolingual is often satisfied with a hazy definition of a word and will use it without understanding it fully (1949, p.188)".

Imedadze (1960) similarily asserts that when the bilingual child "first encounters the fact that an object can have two names, a separation of object and name begins. A word, when freed from its referent can easily become the object of special attention (quoted by Diebold, 1968, p.236)".

The objectification hypothesis has the advantage that the observations on which it is based have received strong empirical support (Ianco-Worrall, 1972) and the role which it attributes to the bilingual's two linguistic codes in promoting cognitive development is quite compatible with both the Vygotskian and Piagetian positions regarding the role of language in cognitive development.

Ianco-Worrall (1972) supported Leopold's (1949) observations by showing that bilingual children, brought up in a one-person, one-language home environment, were more sensitive than unilingual children to semantic relations between words and were also more advanced in realizing the arbitrary assignment of names to referents. Unilingual children were more likely to interpret similarity between words in terms of an acoustic rather than a semantic dimension and felt that the names of objects could not be interchanged.

The significance of these empirical findings can be appreciated when they are placed in the context of Vygotsky's lucid description of the relationships between words and concepts in the cognitive development of unilingual children. Vygotsky's description of the rigid association between a word and its referent brings into focus the possible advantages of having more than one word available.

> "The child must learn to distinguish between semantics and phonetics and understand the nature of the difference. At first he uses verbal forms and meanings without being conscious of them as separate. The word to the child is an integral part of the object it denotes ..... We can see how difficult it is for children to separate the name of an object from its attributes ... The fusion of the two planes of speech, semantic and vocal, begins to break down as the child grows older ... (1962, pp.128-129)".

This separation of the semantic and vocal planes of speech, which the research evidence indicates is accelerated by having two words for the same referent, is necessary if the child is to use language effectively as a tool for thinking. Vygotsky (1962, p.110) also argued that being able to express the same thought in different languages will enable the child to "see his language as one particular system among many, to view its phenomena under more general categories, and this leads to awareness of his linguistic operations".

In an earlier paper directly concerned with multilingualism in children, Vygotsky (1935) argued that, depending on the conditions of acquisition of the second language, bilingualism could have either negative or positive consequences for cognitive development. When child bilingualism develops spontaneously, i.e. outside the influence

of training, Vygotsky admitted that it could inhibit the child's mental development through confusion and interference of concepts and associative processes. However, when the application of sound pedagogical principles ensured that each language had an independent sphere of influence, bilingualism could orient the child towards more abstract thought processes "from the prison of concrete language forms and phenomena (p.29)". In terms of Vygotsky's theory of cognitive development, it is inconceivable that bilingualism should not affect the child's development (either positively or negatively) since not only intellectual development but also "character development and emotional development all reflect the direct influence of speech (p.24)".

In view of the fact that Piaget's (1970) theory is perhaps the most conservative of current theories regarding the role attributed to linguistic experience in promoting cognitive growth, it is somewhat surprising to note that the objectification hypothesis emphasizes precisely the same aspect of language as that emphasized by Genevan investigators. For example, Inhelder et al. (1966) point out that "language training ... operates to direct the child's interactions with the environment and thus to 'focus' on relevant dimensions of task situations (p.163)". Sinclair-de-Zwart (1967) similarily notes that "language can direct attention to pertinent factors of a problem, just as it can control perceptual activities ... (quoted by Furth, 1969, p.130)". Although language cannot effect a full transition from one operational stage to another, it can prepare an operation and help children pass to an intermediate stage (Inhelder and Sinclair, 1969). Since operational thinking derives from action not language, linguistic experience, according to Genevan psychologists, is capable of accelerating cognitive growth only to a limited extent.

However, certain differences between the Genevan view of "language" and the bilingual's linguistic experience should be pointed out. In the context of Genevan research, "language" usually refers to specific short-term training procedures. The relative ineffectivensss of "language" in promoting operational growth is due to the fact that operational growth "does not consist in simply incorporating ready-made and readily available data (Inhelder and Sinclair, 1969, p.21)" but in coordinating the feedback derived from the child's own actions on the environment.

The bilingual's access to two linguistic codes represents a very different form of linguistic experience from that provided in short-term verbal training sessions. In the first place the bilingual "training" experience is likely to be undergone over a period of years. Secondly the "training" does not consist in the bilingual incorporating ready-made data from outside as in Genevan (and other) verbal training experiments, but rather in constantly generating data, through his speech actions on the environment, which provide a qualitatively different form of feedback from that provided by a unilingual's speech activity. It is the feedback from these bilingual speech actions which can (according to the objectification hypothesis) accelerate cognitive growth. This assertion is in no way incompatible with Piaget's (1970) statement that "language does not seem to be the motor of operational evolution, but rather an instrument in the service of intelligence itself (p.722)". The objectification hypothesis merely asserts that bilingualism represents a more powerful linguistic instrument than unilingualism with which to operate on the environment. Within the theoretical context of Genevan psychology the greater power of the bilingual instrument in facilitating cognitive growth arises from the feedback generated by the bilingual child's own speech actions which help direct his attention both to the conceptual features of the environment and to the characteristics of his linguistic operations.

In summary, I have tried to show how attempts to account for the influence of bilingualism on cognitive functioning might be integrated with theoretical positions on the role of language in cognitive development. More attention has been devoted to the Piagetian position, not because it is necessarily more valid than other theories, but because it takes a conservative position on the developmental relations between language and thought. In addition, an analysis of language and thought, partly based on Piaget's theory, has been used by Macnamara (1970) to argue that there is no theoretical justification for expecting bilingualism to influence cognitive growth. In opposition to this view, I have argued that, provided initial difficulties in coping with two languages are overcome, bilingualism represents an enriched form of experience which is capable of positively influencing cognitive functioning. This hypothesis is not in any way inconsistent with the Piagetian position on the role of language in cognitive growth.

Summary

Recent research findings indicate that access to two languages in early childhood can accelerate the development of both verbal and non-verbal abilities. There is also evidence of a positive association between bilingualism and both cognitive flexibility and divergent thinking. These findings are in contrast to the results of many earlier studies which found that bilingual children performed at a lower level than unilingual children on measures of verbal intelligence and scholastic achievement.

Several differences both in methodology and in setting distinguish these two types of studies. Studies which have reported positive effects associated with bilingualism have tended to involve balanced bilinguals, i.e. bilinguals who have attained a similar level of skills in both languages. In addition, these studies have been carried out in bilingual learning situations where the L_2 has been a socially relevant language, the learning of which is unlikely to lead to a replacement of the L_1 (usually a prestigious or dominant language). There is evidence that under these conditions a second language can be acquired at no cost to an individual's native language skills. Therefore the balanced bilinguals in recent studies are likely to have had a high level of competence in both their languages.

The bilingual subjects in many earlier studies, however, tended to come from minority language groups for whom the learning of L_2 (usually the majority and more prestigious language) is likely to lead to a gradual replacement of the L_1. Not surprisingly, the results of these studies produced evidence of a "balance effect" in language learning, i.e. that a bilingual paid for his increasing L_2 competence by a lowering of his competence in L_1. Thus, the lower levels of verbal intelligence of the bilingual subjects in these studies may be a reflection of the fact that they are likely to have had less than native-like competence in both their languages.

On the basis of these differences in the linguistic competence of the bilingual subjects in earlier and more recent studies, it is hypothesized that the level of linguistic competence attained by a

bilingual child may mediate the effects of his bilingual learning experiences on cognitive growth. In other words, the bilingual's level of competence in L_1 and L_2 is posited as an intervening variable in the causal chain between cognitive development and more fundamental social, attitudinal, educational and cognitive factors. Specifically, there may be a threshold level of linguistic competence which a bilingual child must attain both in order to avoid cognitive deficits and allow the potentially bereficial aspects of becoming bilingual to affect his cognitive functioning. Bilingualism and unilingualism can both be thought of as instruments which individuals use to operate on their environments. Because of its greater complexity, the bilingual instrument is more difficult to master, but once mastered, has a greater potential than the unilingual instrument for promoting cognitive growth.

One implication of the threshold hypothesis for bilingual education programs is that a program may have a positive influence on the cognitive functioning of children who attain a high level of L_2 skills but a negative influence on the development of children who fail to attain adequate L_2 skills. In evaluations of such programs the very different cognitive performances of these two groups may mask each other when the performance of only the total group is considered.

In the final section, the theoretical assumptions of the threshold hypothesis that, under different conditions, bilingualism can both positively and negatively influence aspects of cognitive functioning, are examined in relation to the broader issue of the role of language in cognitive development. It is argued that there is no inconsistency between the explanatory hypotheses suggested to account for the influence of bilingualism on cognition and even a conservative theory on the developmental interrelations of language and thought, such as that of Piaget.

FOOTNOTES

1. I would like to thank Dr. John Edwards for reading the original manuscript and making many valuable suggestions.

2. Liedke and Nelson (1968) matched bilingual and unilingual groups on age as well as on IQ, SES and sex. However, in Bain's (1974) study the bilingual children were, on average, five months younger than their unilingual counterparts. Although in this study differences between bilingual and unilingual groups on the rule discovery task, in favour of the bilinguals, only approach significance, the result is interesting both because of the lower chronological age of the bilingual group and the fact that the groups were matched on several cognitive variables, i.e. IQ, school grades and developmental level of operations.

3. The comparison of balanced and non-balanced groups with the unilingual group is only relevant within the context of the second interpretation i.e. that divergent thinking skills have been influenced by bilingualism. It does not constitute support for that interpretation. If the first interpretation is correct i.e. if divergent thinking skills are a correlate of second language learning ability, no inferences regarding the possible influence of bilingualism on divergent thinking can be made from the Cummins (1975) data. I am indebted to Professor W. Lambert for pointing this out.

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